Body balance of male football players aged 7-10: pilot study

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Abstract

Objective of the study – body balance is an element needed to perform activities of daily living and do sports. The aim of this study was to evaluate and compare body balance of male football players aged 7-10.

Methods and structure of the study. The study involved 92 football players aged 7-10 (7 years n = 21; 8 years n = 26; 9 years n = 29; 10 years n = 16), members of TOP-54 Football Academy in Biala Podlaska, Poland. Postural balance was tested using ZEBRIS FDM-2 (Force Distribution Measurement) measuring system with WinFDM software during free barefoot standing with eyes open.

Results and conclusions. In the majority of the analysed parameters, significantly higher values of posturographic parameters were found in younger players (7 years) compared to their older peers (10 years). The observed differences probably stemmed from the immaturity of the postural control system in younger boys. It may be related to the lack of ability to fully utilize sensory information. Football training contributes to proper physical and motor development of children and positively influences the formation of the balance control system. An important aspect is a proper selection of loads to ensure that training is beneficial and supports natural ontogenetic development of players at each stage of training

Keywords: *balance, children, football players.*

Introduction. Body balance is motor potential of a human being. It is defined as assuming a desired body position (e.g. standing) and maintaining it in every static and dynamic situation. The conditions for its maintenance are complex. They mainly concern the locomotor system efficiency, speed of reaction and decision making, and the ability to correctly analyse information regarding the current state of the body, the position of its segments and their speed and acceleration. Body balance, as one of the components of coordination abilities, co-occurs with spatial orientation, speed of reaction and movement differentiation [13].

Body balance control includes the ability to anticipate and cope with instability. It occurs based on sensory signals coming from the vestibular system, visual organ and proprioceptors [1, 11, 15].

In each individual, the degree of development of the ability to maintain body balance depends on many factors such as individual genetic and environmental conditions, sports activity, health state or age [5, 6].

The achievement of sports mastery requires proper training planning, appropriately selected methods and forms of work and training loads at all stages of the athlete's development. In this context, body balance is extremely important in many sports, such as gymnastics [10] or handball [14], and in some sports, such as pentathlon or biathlon, it can even determine the final result of an athlete [7, 8] or a biathlete [9]. Body balance also has a significant impact on the quality of performance of technical elements in football, including dribbling [2].

Objective of the study. The aim of this study was to evaluate and compare body balance of male football players aged 7-10.

Participants

The study involved 92 players aged 7-10 (7 years n = 21; 8 years n = 26; 9 years n = 29; 10 years n = 16), members of TOP-54 Football Academy in Biala Podlaska, whose parents gave written consent to participate in it.

Postural balance testing was conducted in March and April 2021 in the Posture Laboratory of the Regional Research and Development Centre at the Faculty of Physical Education and Health in Biala Podlaska, Poland.

The study protocol followed the recommendations of the Declaration of Helsinki. It was approved and received a positive opinion from the Senate Committee on Research Ethics of J zef Pi sudski University of Physical Education in Warsaw (SKE 01-04/2020).

Procedure

Body balance was examined using ZEBRIS FDM-2 (Force Distribution Measurement, 212x60.5x2.1 cm, 120 Hz, System Medical GMBH, Germany) measuring system that recorded the centre of pressure (COP) signal. The platform was connected to WinFDM software for body sway analysis and calibrated before each measurement.

Body balance was assessed under the following conditions: standing barefoot on both feet with eyes open. During the recording of each measurement, the participant remained motionless on the platform in a standing bipedal position. Each body balance measurement lasted 40 seconds. The first and the last five seconds of each measurement were excluded from the analysis, and the 30-second COP displacement records were further analysed.

The following basic parameters were analysed in the body balance assessment:

AoE [mm^2] – area of the centre of pressure (calculated from COP displacements in such a way that 95% of the data was within the ellipsoid and 5% was outside the ellipsoid);

SP [mm] – path length of COP; V [mm/s] – average velocity of COP;

WoE [mm] – width of the ellipse (length of the ellipse in the medial-lateral direction); HoE [mm] – height of the ellipse (length in the anterior-posterior direction).

Statistical analysis

The results were analysed using one-way ANOVA with four levels of the group factor (7 years, 8 years, 9 years, 10 years). Before proceeding with the analysis, the conformity of the distributions to the normal distribution was checked. Statistical significance was set at $p < 0.05$.

Results and discussion. The test of keeping body balance in a standing position with eyes open revealed the highest values and the highest variation of all the analysed parameters in the group of 7-year-old boys, while the lowest values were observed in 10-year-old players (Table 1).

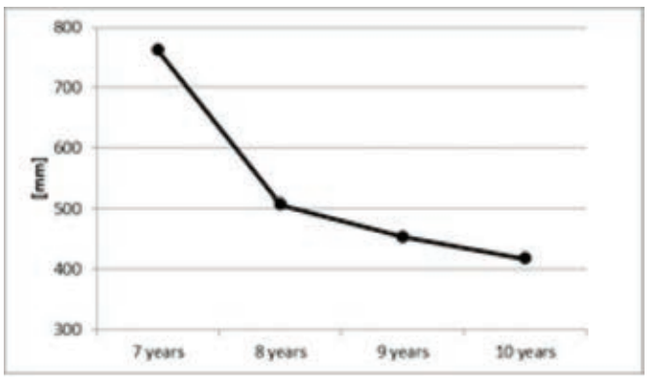
The conducted intergroup statistical analysis showed significant differences between the studied groups of young football players in the path of COP (SP) and its derivative, i.e. mean COP velocity (V). In the case of both parameters, post hoc analysis showed that the values of these indices in the group of 7-year-old football players were significantly higher than in the other age groups. However, there was no difference in the analysed parameters between the other age groups of boys (Figures 1a and 1b).

Statistically significant differences were also noted in the case of the width of the ellipse of the sway area (WoE). WoE values in the group of 7-year-olds were significantly higher than in the group of 10-year-olds (Figure 1c). In the case of the other two parameters, i.e. the size of the COP displacement ellipse area (AoE) and its length (HoE), no significant differences were observed between the studied age groups.

Table 1. *Mean arithmetic values, standard deviations and intergroup significance of differences in body balance parameters in measurements with eyes open*

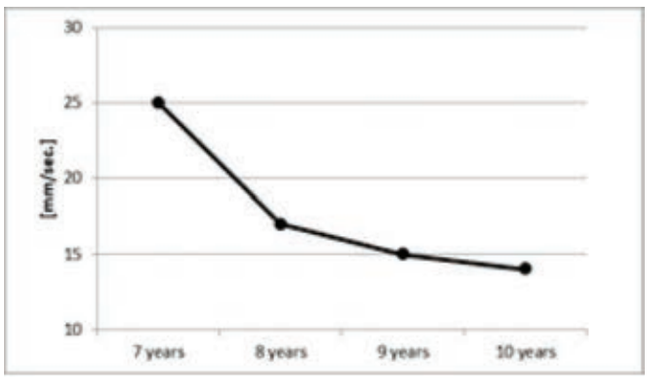
	7 years	8 years	9 years	10 years	p
AoE [mm^2]	714.1 ± 674.5	511.1 ± 260.6	529.4 ± 412.5	316.6 ± 145.4	0.0778
SP [mm]	762.6 ± 399.4	507.7 ± 171.4	454.1 ± 193.2	418.9 ± 117.0	**0.0002**
V [mm/sec]	25.4 ± 12.9	17.2 ± 6.0	15.3 ± 6.6	14.1 ± 3.8	**0.0002**
WoE [mm]	21.8 ± 8.6	18.3 ± 6.7	18.4 ± 7.1	13.4 ± 4.6	**0.0145**
HoE [mm]	36.2 ± 18.9	33.8 ± 9.7	33.3 ± 13.0	29.5 ± 7.2	0.5474

a) SP - Path length of COP



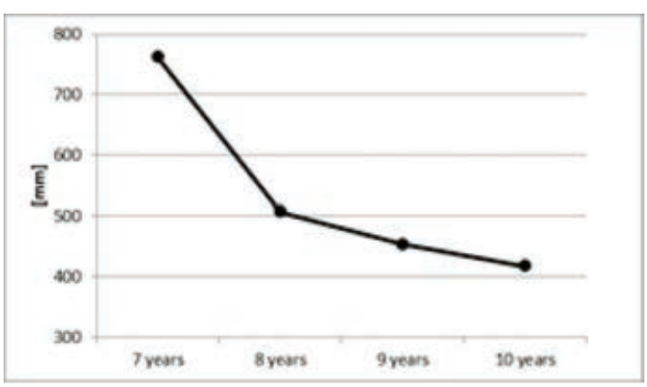
7 years vs 8 years **
7 years vs 9 years ***
7 years vs 10 years ***

b) V - Average velocity of COP



7 years vs 8 years *
7 years vs 9 years ***
7 years vs 10 years ***

c) WoE - Width of the ellipse COP



7 years vs 10 years **

Figure 1. *Values of posturographic parameters significantly different for the studied groups*

It is worth noting that in the case of all the studied parameters, a considerable decrease in their value in the subsequent age groups can be seen, which probably indicates an improvement in body balance with age.

Football is a sport that requires excellent coordination and divided attention. Players must concentrate not only on the ball, but also on the position of their teammates as well as opponents on the pitch and, simultaneously, they control their body position. At the same time, the level of technical and tactical preparation influences the quality of balance control and motor strategies undertaken.

The findings of our study indicate that the maturity of balance reactions improves with age, which is manifested by a decrease in the values of the analysed posturographic parameters (the distance of COP displacement, the average speed of COP displacement, and the width of the ellipse of COP displacement).

Our study showed that 10-year-old football players were more stable compared to players from younger age groups. Our results are consistent with the findings of Triangali et al. [12], who noted better control of body balance in children between 8 and 10 years of age than in younger age groups. However, Peterson et al. [4] emphasise that full maturity of body balance control using vestibular and visual stimuli is achieved by humans around 12 years of age.

Conclusions

Higher values of body balance parameters in younger football players may indicate immaturity of their postural control system. This may be related to the lack of ability to use sensory information.

Properly planned football training supports proper physical and motor development of children and has a positive effect on the development of the body balance control. An important aspect of training is the selection of loads in such a way that they benefit and support natural ontogenetic development of players at each stage of training.

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